GPS Helps Put Manure Where It Counts

Farmers need greater accuracy when applying livestock waste to their fields, to maximize crop yields. Agricultural Research Service scientists at the Soil and Water Conservation Research Laboratory in Lincoln, Nebraska, are working on ways to hit the target and protect groundwater.

Soil scientist James S. Schepers has been studying how to increase the odds of hitting the target with site-specific applications. His overall goal is to improve groundwater quality and prevent leaching of specific chemicals, such as nitrates, into groundwater.

Valuable nutrients found in livestock waste—nitrogen, phosphorus, and potassium—can be lost if not applied where crops can use them. Schepers uses GPS (global positioning system) satellite technology to help farmers identify low-yielding areas in fields and to put nutrients where they are most needed. The wide difference in nutrient availability that can occur in soil within the relatively small space of a single field is referred to as spatial variability.

Most livestock manure is broadcast and is not applied uniformly or to a specific site. Farmers fertilize an entire field and, after adding manure, may eventually double or triple the required nutrient level in some parts of the field while neglecting others, says Schepers.

ARS research uses GPS—a combination of satellite technology and computer programs—to draw a map of a specific crop field that includes such information as per-acre yield data collected during harvest. Such data can be used to determine where manure application might be appropriate.

GPS helps farmers be more cost efficient and environmentally sensitive than traditional broadcast methods of commercial fertilizer or manure application allow.

"This approach is one aspect of precision farming," Schepers says. "But convincing producers to apply the manure on a site-specific basis will require them to recognize spatial variability in crop growth and yields. GPS technologies make it possible to easily locate these variable areas."

Good old-fashioned followup is also required. Farmers will still have to scout their fields on foot to determine the causes of nutrient deficiencies.

"There is no substitute for getting down and looking at the crops," says Schepers, "but GPS can help farmers do a better job of addressing problems."—By **Dawn Lyons-Johnson,** ARS.

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New Biotech Test for Cotton Pests

A new test could let cotton farmers reduce their spraying of pyrethroids. Or it could also help keep these insecticides useful when needed, if no other alternatives are available.

Tobacco budworms, *Heliothis virescens*, and their cotton bollworm cousins, *Helicoverpa zea*, cost southeastern cotton farmers several hundred million dollars a year in damage and chemical controls. Farmers normally control the pests with pyrethroids, which are inexpensive and relatively nontoxic to vertebrates. But the more they use a pyrethroid against budworms, the sooner it "runs out of gas."

That's because the budworm—unlike the bollworm—becomes increasingly resistant to pyrethroids during the growing season.

"Resistance starts low and builds, and it is higher in cotton-growing areas," says Matthew H. Greenstone, an entomologist with the Agricultural Research Service. He's at ARS' Plant Sciences and Water Conservation Research Laboratory in Stillwater, Oklahoma.

"A lot of wasteful, resistance-promoting, and expensive spraying could be avoided by differentiating the two pests at a very early stage," says Greenstone.

Doing this isn't practical now, but it may be in a few years. Greenstone has developed and patented a monoclonal antibody that distinguishes between the pests at the egg stage.

"The antibody binds to the egg protein of the bollworm but not to that of the budworm, so the test is unequivocal," he says.

Greenstone is looking for commercial developers to package the new test in a field kit. "This would enable scouts to determine the proportion of eggs of each species in a sample in just a few minutes," he says. With that information plus total egg counts, farmers could make a speedy decision on whether to spray.

For example, if the proportion of budworm eggs was high, pyrethroids might be advised, provided that total eggs—and budworm resistance—were low. Otherwise, the best strategy might be a combination of different chemical insecticides and biopesticides such as *Bacillus thuringiensis.*

"Widespread use of an egg test kit would reduce pyrethroid sprays, while prolonging their useful life," he says. "Furthermore, using less insecticide overall would conserve the pests' natural enemies, further cutting the need for insecticides."—By **Hank Becker,** ARS.

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